for a high-volume munitions manufacturing facility. Noise reduction costs were estimated by defining workable approaches for the control of all noise sources. Involved were over 1200 machines and some 37 different manufacturing operations. The principal noise sources were punch presses, parts hoppers, parts feed chutes, conveyor lines, tumblers, and other automatic metal-forming and transfer machines. The most prevalent generating mechanisms were the part impacts during transfer and part impact and surface vibration at the punch presses. The goal was to reduce the existing conditions, reaching 110 dB*A* in certain locations, to below the U.S. Army's 85 dB*A* non-time-weighted hearing conservation criterion. The level of design detail of the noise control developed was limited to that required for cost estimation. Design detail for fabrication was not provided since the principal objective was to provide management with program cost data. This crucial information can now be factored into the capital equipment planning function along with traditional projections such as economic equipment life, future production requirements, and equipment modernization schedules.

3:45

W10. Noise control for fan and vent shafts in subways. Peter Y.N. Lee (Wilson, Ihrig & Associates, Inc., 5605 Ocean View Drive, Oakland, CA 94618)

Subway fan and vent shafts can be significant sources of noise impact to both the adjacent community and to patrons in the subway stations. For fan shafts, the transmission of airborne noise through the shafts and surface openings to adjacent buildings and the transmission of noise through the subways to station platform are intrusive. For vent shafts airborne noise transmissed from trains passing by in the subway below to surface openings can be intrusive. The primary methods available for the reduction of fan and train noise propagated out shaft openings and fan noise propagated into the stations are (1) the use of acoustical absorption material on the interior surfaces of fan rooms, fan and vent shafts and tunnel walls and ceilings, (2) the use of sound attenuators [silencers] attached to the fans, (3) the use of specially constructed splitters in the fan and vent shafts or fan rooms, and (4) the use of acoustical louvers.

4:00

W11. Prediction of sound pressure levels in irregularly shaped factory spaces. J.H. Zinskie, L.D. Mitchell, and C.J. Hurst (Virginia Polytechnic Institute and State University, Department of Mechanical Engineering, Blacksburg, VA 24061)

The prediction of sound pressure levels in irregularly shaped factory spaces is approached through an analysis of acoustically coupled rooms. Previous work has indicated that room surface sound absorption characteristics create a theoretical interdependence between the sound pressure fields in each coupled volume. Whenever a barrier is interposed between a sound source and observer, the effects of diffraction must also be considered. A computer algorithm was developed to predict sound pressure levels in irregularly shaped rooms using a modified statistical acoustic theory. The program is based on a conversational technique and requires the user to enter information regarding room geometry, surface absorptions, receiver placements, and source sound power and placement information. Several output options are provided, among which is a plan view print-plot of sound pressure level contours in the analysis room. [Work supported by NSF.]

WEDNESDAY, 17 NOVEMBER 1976 SENATE/COMMITTEE ROOM, 2:00 P.M.

Session X. Physical Acoustics IV

Wayne M. Wright, Chairperson

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Contributed Papers

2:00

X1. Generalized theory of the photoacoustic effect. F.A. McDonald and G.C. Wetsel, Jr. (Department of Physics, Southern Methodist University, Dallas, TX 75275)

The photoacoustic effect is the production of an acoustic signal when a sample in an enclosed cell is illuminated with chopped light. The absorbed light produces a periodic heat flow from the sample to the surrounding gas and backing material, causing pressure variations in the gas which are detected by a sensitive microphone. A theoretical treatment will be presented which involves simultaneous solution of thermal-diffusion equations for the sample and backing material and fluid-dynamic equations for the gas. The resulting acoustic signal depends on the chopping frequency, the optical absorption coefficient and thermal properties of the sample, and on other material and system parameters. The conditions under which the approximate treatment of Rosencwaig and Gersho [J. Appl. Phys. 47, 64—69 (1976)] is valid will be discussed. Application of the theory to solid and liquid samples will be considered.

2:15

X2. Experimental investigation of the photoacoustic effect in liquids and solids. G.C. Wetsel, Jr., and F.A. McDonald (Department of Physics, Southern Methodist University, Dallas, TX 75275)

The photoacoustic effect in liquids and solids has been experimentally investigated using light from helium—neon and argon—ion lasers. In an effort to evaluate the theoretical explanation of the effect (see preceding paper), the photoacoustic amplitude Q has been measured as a function of chopping frequency f for several liquids and solids with large values of the optical absorption coefficient β. The experimental results compare favorably with theoretical predictions over wide ranges of f and β. Water solutions with varying concentrations of a common pH indicator were prepared to obtain a controlled evaluation of $Q(f,\beta)$. It was found that curve fitting the theory to the experimentally determined graph of Q vs f permits the determination of β to at least two significant figures for a solute in water with a β range of at least 50—5000 cm^{-1}. This result indicates that the photoacoustic effect provides an